

Melissa McCann  
March 15, 2016

## Vibrato rate in female opera singers and female sertanejo singers

### INTRODUCTION

Scientific studies, *Vibrato rate variability in three professional singing styles: Opera, Rock and Brazilian country*<sup>1</sup> and *The Characterization of the Vibrato in Lyric and Sertanejo Singing Styles: Acoustic and Perceptual Auditory Aspects*,<sup>2</sup> have been conducted comparing the vibrato rates of operatic tenors and male *sertanejo* singers.

Without taking style into account, Pecoraro and colleagues found that the vibrato rates for opera and *sertanejo* singers have a similar mean, whereas Bezerra and co-workers found that vibrato rates between lyric and *sertanejo* singers were statistically different and that there was also a difference in oscillation frequency. This is important from a vocal pedagogical standpoint, because vibrato is a symptom of healthy phonation. Neither of the studies consider the other important technical aspects related to either style of singing. In addition, the experiments only use examples from western classically trained tenors and male *sertanejo* singers. Therefore, the data may not be representative of a larger population of singers.

---

<sup>1</sup> Guilherme Pecoraro, Daniella F. Curcio, and Mara Behlau. "Vibrato Rate Variability in Three Professional Singing Styles: Opera, Rock and Brazilian Country." 2013.

<sup>2</sup> Adriana De Almeida Bezerra, Sabrina Cukier-Blaj, André Duprat, Zuleica Camargo, and Lídio Granato, "The Characterization of the Vibrato in Lyric and Sertanejo Singing Styles: Acoustic and Perceptual Auditory Aspects." *Journal of Voice* 23, no. 6 (2009): 666-70.

*Música sertanejo* is a popular Brazilian genre in São Paulo, commonly compared to the country-western music of the United States.<sup>3</sup> This genre gained popularity in the urban areas of Brazil in the 1980s.<sup>4</sup> According to Carvalho, the enormous increase in recording sales, radio and TV shows, and *sertanejo* performances “is now being considered a new musical phenomenon in Brazil.”<sup>5</sup>

Dent explains that in the *sertaneja* tradition the image of brothers relates male labor originating in the countryside, then moving to the city. Although Roberta Miranda, the Galvão Sisters, and the Castro Sisters achieved success, *sertaneja* does not “seem likely to be sung by females again anytime soon.”<sup>6</sup> Rodrigo Haddad argues that “you also find more women singing... but like American country music, *sertanejo* is undergoing a crossover trend. To reach larger audiences, many *sertanejo* bands are borrowing from the American country tradition...”<sup>7</sup> Bruce Gilman explains that musicians are abandoning the conventional *sertanejo* style to attract a “younger and more urban audience.” In 2011, Michel Tel released his hit single *Ai se eu te pego* reaching over 500 million views on YouTube.<sup>8</sup> This unprecedented musical phenomenon sparked a new trend in *sertanejo* which led to the emergence of a subgenre known as *sertanejo universitário*. This new style earned its name from its popularity with college students. Carvalho explains that

---

<sup>3</sup> Phillip Jandovsky, "Sertanejo." Great Brazilian Music -. Accessed February 11, 2016. <http://www.greatbrazilianmusic.com/sertanejo.html>.

<sup>4</sup> Carvalho, "Musical Style, Migration, and Urbanization: Some Considerations on Brazilian Música Sertaneja."

<sup>5</sup> Ibid.

<sup>6</sup> Dent, *River of Tears*, 72.

<sup>7</sup> Jason Birmingham, "Sao Paulo Music: A Long Way from Nashville." Gringoes. February 28, 2005. Accessed February 11, 2016. [http://www.gringoes.com/articles.asp?ID\\_Noticia=703](http://www.gringoes.com/articles.asp?ID_Noticia=703).

<sup>8</sup> Lourdes Casanova and Julian Kassum, *The Political Economy of an Emerging Global Power: In Search of the Brazil Dream*. UK: Palgrave Macmillan, 2014, 11.

“the modern musica sertaneja performer is no longer a cantador for whom the narrative was the most important element of the song. Now, musical interpretation, vocal style, and orchestration are crucial for the success of a song. Musica sertaneja singers (or cantores) ornament their interpretations with heavy vibrato and portamentos, producing a fuller sound in comparison with the musica caipira rash and nasal performance.”<sup>9</sup>

*Sertanejo* is one of the most popular genres in Brazil, but its place in society is filled with irony. Over the last 50 years, living conditions have significantly improved in the interior states, and as a result, they are no longer associated with the sertão.<sup>10</sup> In addition, the use of more sophisticated language in the lyrics of *sertanejo* represents a social ascent from the rural countryside to the modern city.<sup>11</sup> The stylistic changes and preservation of the traditional aspects of the music shows that the people have been not been corrupted by the urban experience.<sup>12</sup>

## REVIEW OF LITERATURE

James McKinney defines vibrato as the acoustic phenomenon defined by wave frequency, amplitude, and variance.<sup>13</sup> Clifton Ware adds that the sensation of vibrato occurs when the nerves supply impulses to the laryngeal muscles as an alternating current creating movements between agonist and antagonist muscles.<sup>14</sup> This process is combined with the activity of the breathing muscles and diaphragm, resonating cavities, and

---

<sup>9</sup> Carvalho, "Musical Style, Migration, and Urbanization: Some Considerations on Brazilian Música Sertaneja." *Popular Culture* 1993, 12:75-93.

<sup>10</sup> Jandovsky, "Sertanejo."

<sup>11</sup> "Brazil: Central and Southern Areas." *Garland Encyclopedia of World Music Volume 2 - South America, Mexico, Central America, and the Caribbean*.

<sup>12</sup> Ibid.

<sup>13</sup> James C. McKinney, *Diagnosis and Correction of Vocal Faults A Manual for Teachers of Singing and for Choir Directors*. Waveland Press, 2005, 196.

<sup>14</sup> Ware, Clifton. *Adventures in Singing: A Process for Exploring, Discovering, and Developing Vocal Potential*. Boston: McGraw-Hill, 2008, 96.

laryngeal cricothyroid muscles. As a result, vibrato is integrally related to pitch, timbre, airflow, and nerve energy.<sup>15</sup>

According to Meribeth Dayme, the ideal vibrato has consistent, even acoustic waves. The ear prefers a pitch vibrato that contains five to eight cycles per second and varies one semitone around the pitch.<sup>16</sup> The rate of intensity and pitch are roughly the same, and the average variation is between two and three decibels.<sup>17</sup> Richard Miller explains that when deeper, darker elements are emphasized, the vibrato rate is slower and wider, and when the lighter elements are at play, the frequency is faster. The well trained singer keeps both elements in balance so that the tone has a “bottom” and “top.” A slower vibrato rate may have a weightier quality with the tendency toward a vibrato rate of approximately five cycles per second.<sup>18</sup>

Pecoraro and colleagues evaluated 423 samples from five professional male singers of each genre: opera, rock, and *sertanejo* from commercially available CDs. They analyzed the vibrato rates independent of the singing style and determined that the mean vibrato rate (MVR) was equivalent for *sertanejo* singers (MVR= 5.91 Hz) and opera singers (MVR= 5.77 Hz) and significantly higher for both in comparison with that of rock singers (MVR= 5.04).<sup>19</sup> However, the examples used in this experiment were taken from older recordings which would exclude the changes in *sertanejo* singing style that occurred in the last twenty years.

---

<sup>15</sup> Ibid.

<sup>16</sup> Dayme, Meribeth. *Singing Book - Third Edition*. New York: W. W. Norton, 2014, 278.

<sup>17</sup> McKinney, 197.

<sup>18</sup> Richard Miller, *National Schools of Singing: English, French, German, and Italian Techniques of Singing Revisited*. Lanham, MD: Scarecrow Press, 1997, 95.

<sup>19</sup> Pecoraro, Guilherme, Daniella F. Curcio, and Mara Behlau. "Vibrato Rate Variability in Three Professional Singing Styles: Opera, Rock and Brazilian Country." 2013.

Bezerra and colleagues analyzed the production of vibrato in 10 operatic and 10 *sertanejo*, male singers, in good laryngeal health, from an acoustic and perceptual standpoint. After recording and analyzing the overtones and vibrato rates, the spectrograms showed that opera singers showed regular oscillation frequency and that *sertanejo* singers showed irregularity. Additionally, the investigators found that the MVR for the *sertanejo* singers (MVR= 5.82 Hz) was statistically different than for the classically trained singers (MVR=5.10)<sup>20</sup> These results differ from the findings of Pecoraro's group in which no difference was found in MVR produced by singers from operatic and *sertanejo* genres.

## AIM

The aim of this study was to compare female vibrato rates in two styles of singing, western classical and *sertanejo*. This study was conducted in order to determine if different technical approaches yield a different mean vibrato rate in female singers. Examples were taken from well-known, operatic sopranos and popular female *sertanejo* singers. The program Vocevista was used to gain quantitative data on the singers' vibrato rates and vibrato extent. A purpose of this study is to determine if the findings of similar mean vibrato rate for tenors singing in operatic and *sertanejo* genres, also hold true for female vocalists singing in these genres. The intent of this study is to eliminate gender bias in the initial research and to reveal broader implications for further research.

---

<sup>20</sup> Bezerra, Adriana De Almeida, Sabrina Cukier-Blaj, André Duprat, Zuleica Camargo, and Lídio Granato. "The Characterization of the Vibrato in Lyric and Sertanejo Singing Styles: Acoustic and Perceptual Auditory Aspects." *Journal of Voice* 23, no. 6 (2009): 666-70.

## METHODS

Seven operatic sopranos and seven female *sertanejo* commercial voice recordings were the subject of this study. Acoustic analysis was conducted in which vibrato rate (Hz) and vibrato extent (semitones) was measured, using Vocevista software. All samples were played and recorded by Vocevista until approximately four or more vibrato cycles were obtained to record an average rate. The classical western samples were taken from a capella pieces or at a moment in the music with no accompaniment in order to eliminate interference. The *sertanejo* samples were entered into FLstudio. FL Parametric Equalizer 2 was used as a post effect on the track in order to take out frequencies below 327 and frequencies above 2500. This was done in order to isolate the vocals from the instrumental filled songs. The tracks were exported as an mp3 at 160kps for accurate analysis in Vocevista. The vibrato and extension rates of the classical western singers and the *sertanejo* singers were measured by direct reading from Vocevista to determine the differences and similarities. The analysis was based on the clearest harmonic from each sample.

The vibrato rates and vibrato extensions were compared between the operatic and *sertanejo* styles using statistical analysis according to 5% ( $p$  is less than or equal to 0.05) significance to determine statistical significance. The statistical test applied was the  $t$ -test (Fig. 2).

## RESULTS

Figure 1 shows the vibrato rate and extension values produced by the western classical singers and the *sertanejo* singers. Figure 2 illustrates the statistical comparison of mean vibrato rate and mean extensions in western classical singers and *sertanejo* singers using the *t*-test for significance testing. Table 1 provides printed images of the vibrato rate and extensions for each of the classical and *sertanejo* singers obtained from Vocevista.

Fig. 1 *Vibrato Rate and Extension*

Western Classical			<i>Sertanejo</i>		
	Rate	Extent		Rate	Extent
Barbara Hendricks	6.7	0.78	Vanessa da Mata	6.2	1.23
Kathleen Battle	6.1	0.63	Roberta Sa	6.1	0.59
Renee Fleming	6.1	1.25	Paula Mattos	8.4	0.69
Anna Netrebko	5.6	1.27	Paula Fernandes	7.4	0.5
Diana Damrau	6.1	1.53	Ivete Sangalo	6.8	0.5
Angela Gheorghiu	5.4	0.96	Roberta Miranda	7.6	1.15
Natalie Dessay	5.3	0.7	Adriana Calcanhotto	6.8	0.49
Mean	5.9	1.0171429		7.042857	0.735714
Standard deviation	0.49329	0.3394		0.8162	0.31905
Min	5.3	0.63		6.1	0.49
Max	6.7	1.53		8.4	1.23

Fig. 2 *Comparison of Vibrato Rate and Extension in Opera and Sertanejo*

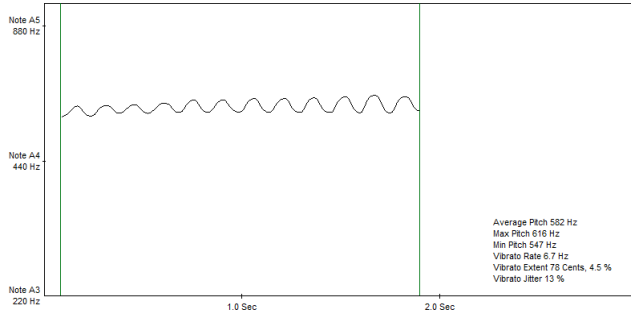
		Standard Deviation	Standard Error	T	P
Vibrato Rate	Opera	0.49329	0.1864	-3.171	0.00481
	Sertanejo	0.8162	0.3085		
Vibrato extent	Opera	0.3394	0.1283	1.598	0.93238
	Sertanejo	0.31905	0.1206		

Table 1 *Images of Vibrato Rate and Extension in Opera and Sertanejo*

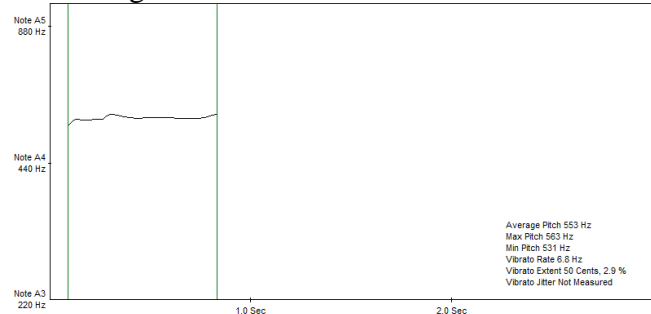
Classical Sopranos

Sertanejo Singers

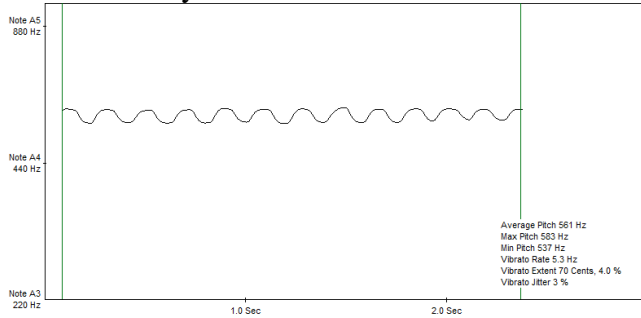
Barbara Hendricks



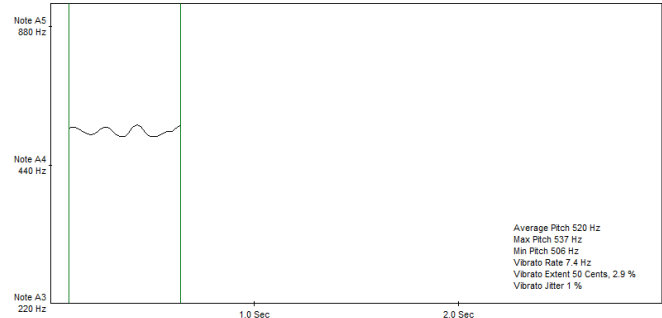
Ivete Sangalo



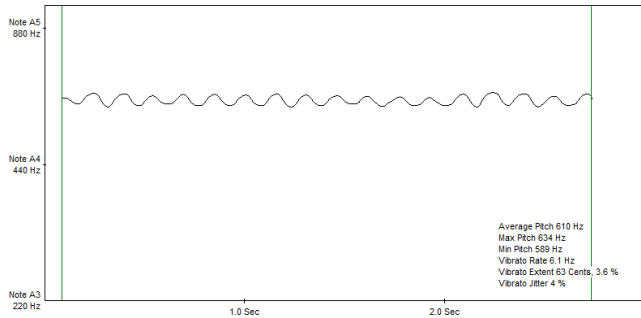
Natalie Dessay



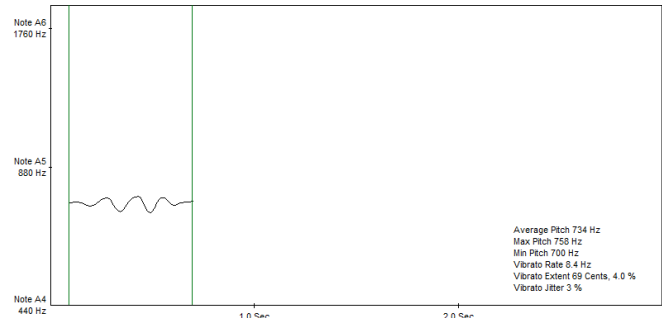
Paula Fernandes



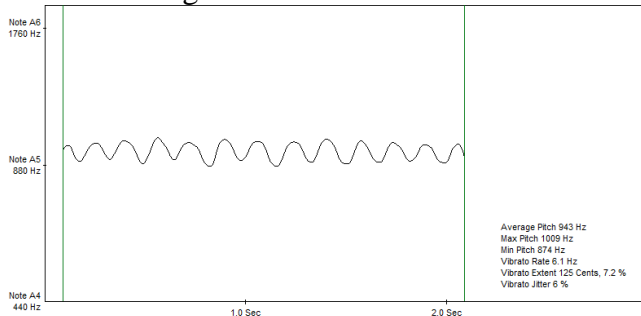
Kathleen Battle



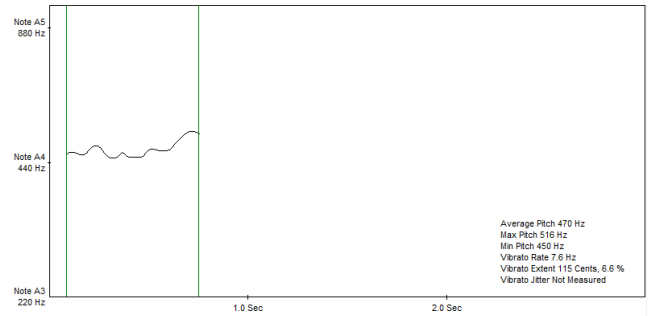
Paula Mattos



Renee Fleming

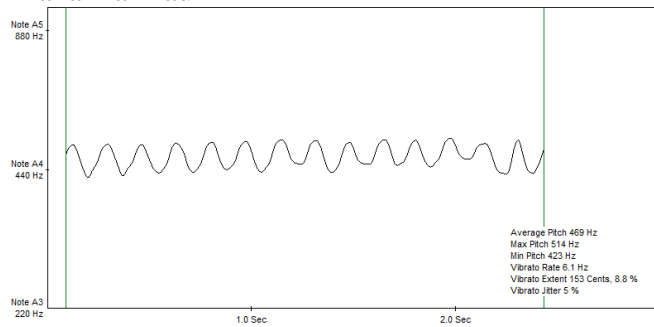


Roberta Miranda

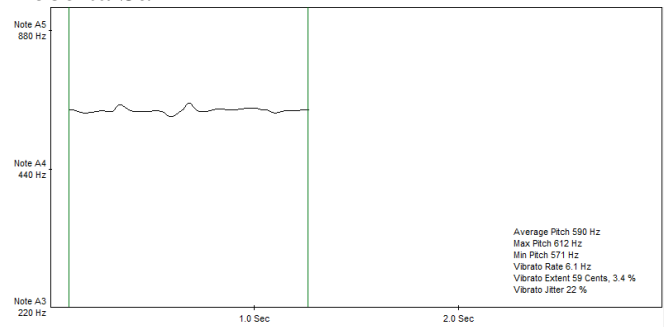




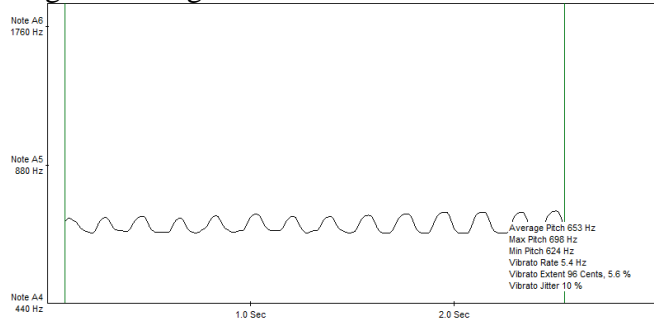
## Diana Damrau



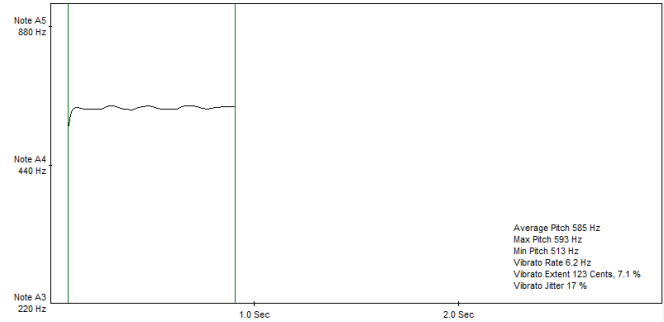
## Roberta Sá



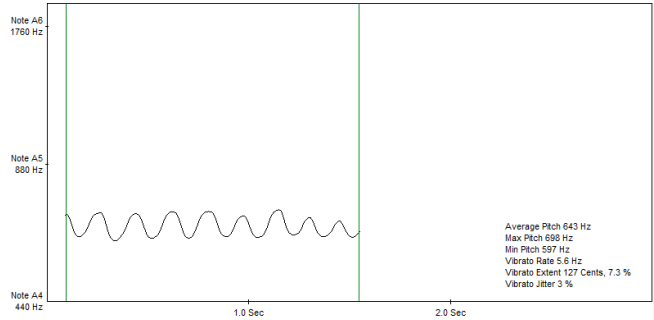
## Angela Gheorghiu



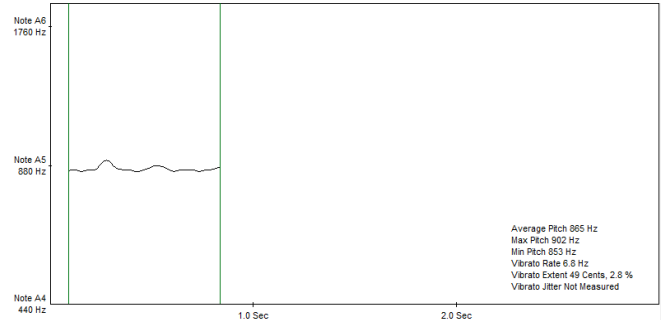
## Vanessa da Matta



## Anna Netrebko



## Adriana Calcanhotto



## DISCUSSION & CONCLUSION

The aim of this study was to analyze and compare the vibrato rates between western classically trained sopranos and female *sertanejo* singers. The range in values in vibrato rates for the classical sopranos was 5.3 to 6.7 Hz, with corresponding extension rates that ranged from 0.63 to 1.53 semitones. The range in values in vibrato rate for the female *sertanejo* singers was 6.1 to 8.4 Hz, with corresponding extensions that ranged from 0.49 to 1.23 semitones. Between the two genres there was a highly significant statistical difference in mean vibrato rate ( $p=.005$ ). However, no statistical difference ( $p=.932$ ) was found in the mean vibrato extent ( $p=.932$ ) between the classical western singers and the *sertanejo* singers.

The results of this study in female singers differ from Pecoraro and his colleague's findings that MVRs were equivalent between male opera and *sertanejo* singers. Interestingly, the MVRs found in the female opera singers used in this study were very similar to the MVR reported for both the male opera and *sertanejo* singers in Pecoraro's study. However, the present findings are similar to Bezerra's study which showed that the MVRs for male singers in the opera and *sertanejo* genre were significantly different. The MVR found in the present study, for female singers in the *sertanejo* genre, was higher than the MVRs reported for male singers in all categories in both the Pecoraro and Bezerra studies. All three studies found MVRs that fall within the normal range of five to seven Hz, however, individual vibrato rates for three of the seven (43%) female *sertanejo* singers ranged outside of normal parameters.

The present findings for female singers are not surprising and coincide with the initial hypothesis that there would be a difference in the mean vibrato rates between singers from the classical and *sertanejo* genres. This difference is likely due to the distinctive styles of each genre. Unfortunately, both Pecoraro and Bezerra excluded style differences as a consideration in their study design and evaluation of male singers.

It is extremely difficult to compare western classical singing and *sertanejo* singing. Style *does* need to be taken into consideration for analysis because of the nature in which the voice is used. The classical western technique relies only on acoustics. All other popular styles, including *sertanejo*, rely exclusively on microphones for amplification. The fact that *sertanejo* began in the countryside could explain why male singers originally used a high, nasal vocal placement in order to amplify their voices outdoors. Nevertheless, this type of vocal production is not prevalent today, due to electronic means of projection. The female singers analyzed do not exhibit the same singing technique as their male counterparts, but their unique style greatly affects their vocal production.

The nature of the style in singing greatly affected the results of this study and created a margin of error. All of the classical soprano recordings contained notes that were sustained for 1.5 seconds or more, yet the *sertanejo* singers only sustained notes for a fraction of that time. Though it was possible to obtain at least four measurable vibrato cycles from the *sertanejo* recordings, it may not be an accurate representation to compare a length of vibrato that lasted for 2 seconds to that of .5 seconds. In addition, the only *sertanejo* recording that was *a capella* was Roberta Miranda. However, she is one singer

who consistently sustained her notes for the shortest period of time, so it was difficult to obtain an accurate reading. In *sertanejo* recordings that were not *a capella*, the instrumentation caused complications in obtaining an accurate vibrato analysis because it was difficult to isolate the voice, especially through post-production effects.

Classical singing is an elite learned behavior, whereas pop singing, including *sertanejo*, is vernacular in style. Therefore, pop singing conforms to speaking patterns and is less concerned with vocal coordination and other characteristics that you would expect to detect in a classically trained singer. The results shown in Table 1 visually illustrate that vibrato cycles for the classically trained female singers are regular and consistent. Also, the entire sample of classically trained singers sustained pitch for lengthy periods. In contrast, the oscillations for the *sertanejo* singers were irregular and shorter in number, i.e., the singers did not sustain pitch very long. This lack of prolongation corresponds to the vernacular style in which speech tones are not extended.

The female *sertanejo* singers utilize a more speech-like register rather than exclusive head voice use. As a result, they do not sustain tones like the western classically trained sopranos. It is difficult to determine the rate of vibrato when a speech-like pattern of singing is used because it does not render enough consistent vibrato cycles. The female *sertanejo* singers are able to use microphones to their advantage to be heard over a band. Therefore, they are able to sing in lower registers and can still be heard without having to rely on sustained notes to project the meaning of the text. This same technique is inefficient for the classically trained western singer because she must convey the meaning of the text on sustained vowels and short consonants in an unaided register.

All styles of singing should exhibit some vibrato because this phenomenon is a symptom of good vocal production. It is important to analyze *sertanejo* technique regarding vibrato not only because this is one of the most popular styles in Brazil, but also so that voice teachers and coaches can understand how to analyze and assist pathological singing.

*Sertanejo* represents a dichotomy between country and urban, and past and present. This genre has truly made an evolution from singing with guitars to full-scale productions, and even accepting women into a male-dominated genre. The fact that more and more women are accepted as professional singers is another indication of how *sertanejo* has evolved with the times. As *sertanejo* makes a shift to attract younger audiences, more and more female singers will begin to sing and perform in this style. These young women will need teachers to guide them in creating the most efficient technique. Using Vocevista and analyzing vibrato is just one method that can be used to give insight into the vocal process. The results of the present study will inform private studio practice by identifying inherent differences between pop and classical singing styles. This may be important in training students who wish to crossover from one genre to another. Future studies examining vibrato rates in both male and female singers should include an evaluation of vocal style differences in order to more accurately determine how vibrato is a part of the coordination of the vocal processes.

## REFERENCES

- Bezerra, Adriana De Almeida, Sabrina Cukier-Blaj, André Duprat, Zuleica Camargo, and Lídio Granato. "The Characterization of the Vibrato in Lyric and Sertanejo Singing Styles: Acoustic and Perceptual Auditory Aspects." *Journal of Voice* 23, no. 6 (2009): 666-70.
- Birmingham, Jason. "Sao Paulo Music: A Long Way from Nashville." Gringoes. February 28, 2005. Accessed February 11, 2016.  
[http://www.gringoes.com/articles.asp?ID\\_Noticia=703](http://www.gringoes.com/articles.asp?ID_Noticia=703).
- Carvalho, Martha de Ulhôa. 1993. "Musical Style, Migration, and Urbanization: Some Considerations on Brazilian *Música Sertaneja*." *Studies in Latin American Popular Culture* 12:75-93.
- Casanova, Lourdes, and Julian Kassum. *The Political Economy of an Emerging Global Power: In Search of the Brazil Dream*. UK: Palgrave Macmillan, 2014.
- Dayme, Meribeth. *Singing Book - Third Edition*. New York: W. W. Norton, 2014.
- Dent, Alexander Sebastian. 2009. *River of tears : country music, memory, and modernity in Brazil*. n.p.: Durham, NC : Duke University Press, 2009.
- Jandovsky, Philip. "Sertanejo." Great Brazilian Music -. Accessed February 11, 2016.  
<http://www.greatbrazilianmusic.com/sertanejo.html>.
- McGowan, Chris. "The Brazilian sound: samba, bossa nova, and the popular music of Brazil." *CHOICE: Current Reviews for Academic Libraries*, 2009.
- McKinney, James C. *Diagnosis and Correction of Vocal Faults A Manual for Teachers of Singing and for Choir Directors*. Waveland Press, 2005.

- Miller, Richard. *National Schools of Singing: English, French, German, and Italian Techniques of Singing Revisited*. Lanham, MD: Scarecrow Press, 1997.
- Olsen, Dale A., and Daniel E. Sheehy, eds. "Brazil: Central and Southern Areas." *Garland Encyclopedia of World Music Volume 2 - South America, Mexico, Central America, and the Caribbean*. Routledge, 1998. 320-42. Accessed February 11, 2016. <http://search.alexanderstreet.com/view/work/1000223481>.
- Pecoraro, Guilherme, Daniella F. Curcio, and Mara Behlau. "Vibrato Rate Variability in Three Professional Singing Styles: Opera, Rock and Brazilian Country." 2013.
- Reily, Suzel Ana. 1992. "Música Sertaneja and Migrant Identity: The Stylistic Development of a Brazilian Genre." *Popular Music* 11 (3):337-358.
- Rosa, Lorena Luiza Costa, and Sílvia Maria Rebelo Pinho. 2003. *Vibrato sertanejo: análise acústica e correlatos fisiológicos no trato vocal*.
- Ware, Clifton. *Adventures in Singing: A Process for Exploring, Discovering, and Developing Vocal Potential*. Boston: McGraw-Hill, 2008.